



Operating System

Automated Deployment Options

White Paper

Abstract

New deployment tools and methods introduced with the Microsoft® Windows® 2000 Professional operating system make it easier, more efficient, and less expensive to deploy. This paper describes several options that organizations can choose if they wish to deploy Windows 2000 Professional automatically.

This document is based on features in the Beta 3 version of Windows 2000 Professional, released in April 1999. Readers should be aware that features in the final released version of Windows 2000 Professional may vary from those in beta versions of the product.

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CONTENTS

INTRODUCTION	1
Automated Deployment Methods	1
USING AUTOMATED INSTALLATION SCRIPTS	2
Setup Manager	3
DISK-IMAGE COPYING.....	7
System Preparation Tool	7
Mini-Setup Wizard	7
Command line options	8
System Preparation Tool Answer File (Sysprep.inf)	8
Using the Same Image on Different Hardware Configurations	9
REMOTE OPERATING SYSTEM INSTALLATION.....	10
CD-ROM-Based Installation	10
Disk Image-Based Installation	10
USING SYSTEMS MANAGEMENT SERVER	11
UPGRADING TO WINDOWS 2000 PROFESSIONAL	12
Compatibility Checker	12
Upgrading from Windows NT Workstation 3.51 and Windows NT Workstation 4.0	13
Upgrading from Windows 95 and Windows 98	14
Ensuring Application Compatibility	14
Key considerations in the Windows 95/Windows 98 upgrade process	14
INSTALLING SERVICE PACKS	16

INTRODUCTION

Until recently, any organization that deployed a desktop operating system had to invest a significant amount of money and resources in the deployment process. Even so-called automated deployment methods were expensive and drained resources—the methods were not always truly fully automated, and since these methods were usually too complicated for novices to use, even a partially automated deployment required the attention of an information (IT) professional.

Deployment tools and methods introduced with Microsoft® Windows® 2000 Professional, Microsoft's latest desktop operating system for businesses, make it easier, more efficient, and less expensive to deploy. Based on the results of research with business customers, and specifically IT professionals who deploy desktop systems, Microsoft designed Windows 2000 Professional from the ground up to improve automated deployment.

Automated Deployment Methods

Windows 2000 Professional supports a variety of automated deployment methods. These methods are:

- Automated installation scripts
- Disk imaging, or cloning
- Remote installation
- Electronic distribution.

Business users can also migrate to Windows 2000 Professional from any of the following operating systems. The upgrade process for each operating system can be completely automated and scripted.

- Windows NT Workstation 4.0
- Windows NT Workstation 3.51
- Windows 98
- Windows 95

This paper discusses the improvements made to each of the above automated deployment methods.

USING AUTOMATED INSTALLATION SCRIPTS

Automated installation scripts are used to answer questions during setup. A well-crafted, truly automated script saves an organization time and resources—administrators need not visit each desktop during installation, and users need not answer questions during installation.

The following is how Windows 2000 Professional significantly expands support for automated installation scripts:

- **Nearly all aspects of installation can be scripted.** Windows 2000 Professional supports keys that make it possible to script a complete installation, including installation of modems, sound cards, time-zone settings, and other components that, traditionally, have been difficult to script. Windows 2000 Professional supports several tools that make it easier for administrators to add uniqueness to systems, such as setting static IP addresses or using a list of machine names.
- **Installation can be completed with no user interaction.** Nearly all aspects of Windows 2000 Professional can be installed without requiring input from the user.
- **Setup Manager makes it easier to create scripts.** A graphical tool, Setup Manager, takes care of many challenging tasks, such as using correct syntax and eliminating typographical errors, that have traditionally made script-writing difficult for administrators. Setup Manager can also create or import universal disk format (UDF) files that are used to apply unique settings to desktops.
- **It's also easier to create distribution shares.** Using Setup Manager an administrator can include components such as unique device drivers that are not part of the original Windows 2000 Professional installation CD-ROM. Windows 2000 Professional also supports system startup CD-ROMs, which make it easier to deploy the operating system on computers that do not have high-speed connectivity.
- **Scripts are more reliable.** The Windows 2000 Professional setup process does not halt the installation process if a non-critical device—for example, a modem—does not install properly. Reporting mechanisms are also better, making it easier for administrators to troubleshoot installations that fail.

Setup Manager

The Windows 2000 Professional Setup Manager is a comprehensive wizard-based feature that guides administrators through the process of creating custom setup scripts. Administrators can use Setup Manager to set many of the answer-file parameters that automate the setup process and therefore require no user interaction; for example:

- **Set user interaction.** This sets the level of user interaction that is appropriate during the setup process.

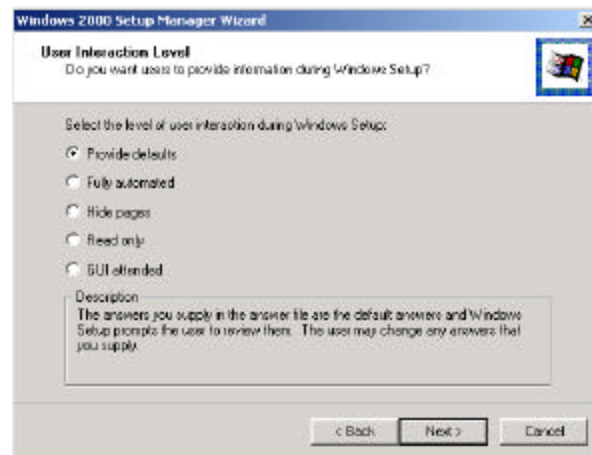


Figure 1. Windows 2000 Professional administrators can use the Setup Manager Wizard to set the level of user interaction required during the setup process, from allowing the user to review and change defaults to fully automating and hiding the setup process from the user.

- **Set default user information.** Specify an organization or user name.

- **Define computer names.** When an administrator enters multiple names during the setup process, Setup Manager automatically generates the .udf that is required in order to add those unique names to each system during setup. If the administrator imports names from a text file, Setup Manager converts each name to a .udf. The administrator can also set an option to generate unique machine names.

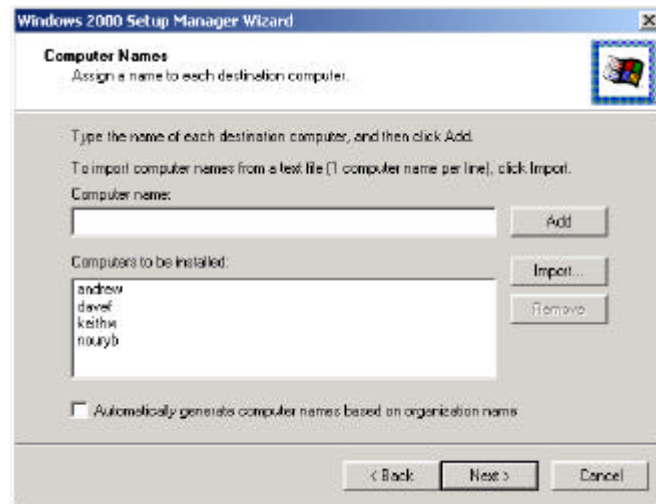


Figure 2. The user interface in the Setup Manager Wizard is identical to the interface in the network settings.

- **Set an administrator password.** The administrator can set an administrative password and hide it from users. The Setup Manager Wizard can also be set to prompt the user for the administrative password during setup.
- **Display settings.** The administrator can automatically set the display color depth, screen area, and refresh frequency display settings.

- **Configure network settings.** Any custom network-setting option that can be configured from the desktop can be configured remotely using the Setup Manager Wizard. The interface for setting network settings in the wizard is the same interface that the user sees on their desktop. Using Setup Manager the administrator can also join computers to a domain or workgroup, or automatically create accounts in the domain.

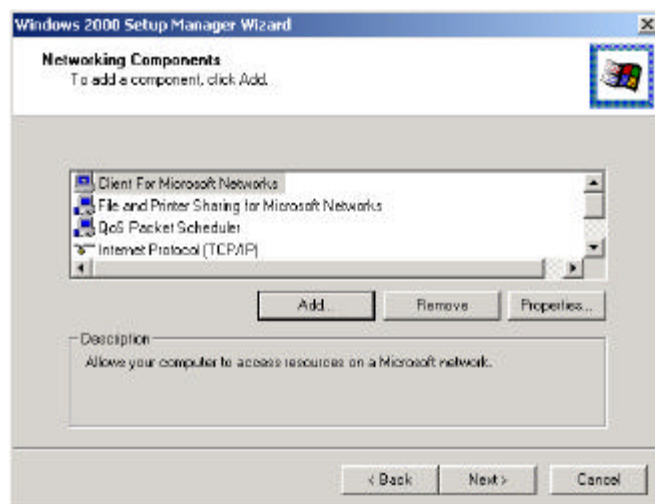


Figure 3. The administrator can configure which networking components will be available for the user using the Setup Manager Wizard.

- **Set time zone and regional settings.** Set the correct time zone using the same property sheet that a user would access to change the time zone locally. Specify regional settings such as date, time, numbers, character sets, and keyboard layout.
- **Internet Explorer 5 settings.** The administrator can use Setup Manager to carry out the basic setup for Internet connections, such as connecting to proxy servers. If the organization wishes to customize the browser, the administrator can use Setup Manager to access the customization tool that is part of the Internet Explorer Administration Kit available from www.microsoft.com/windows/ieak.
- **Set telephony settings.** Set telephony properties such as area codes and dialing rules.
- **Add cmdlines.txt files.** These files are used to install additional components, such as applications. For example, the administrator can add the command line to run office setup by including the command line for office setup in the cmdlines.txt file.
- **Create an installation folder.** Use the default installation folder, \\winnt, to generate a unique folder during setup or to set a custom folder.
- **Install printers.** Set up multiple printers as part of the installation process.

- **Add commands to the Run Once section.** Set up commands that will run automatically the first time a user logs on. These may include running an application setup program, running a resource-kit utility, or changing security settings.
- **Run commands at end of setup.** Specify commands that run at the end of the setup process and before users log onto the system, such as launching an application setup file.
- **Copy additional files.** Specify additional files to be copied to the user's desktop, such as device-driver libraries. The administrator can also use Setup Manager to specify where these files are copied.
- **Create distribution folder.** Create a distribution folder on the network that includes the required Windows source files. You can also add files that you want to copy or supply additional device drivers for use with Windows.

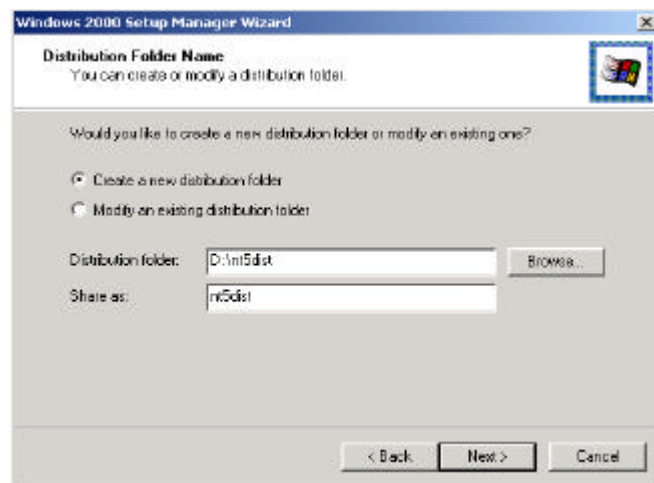


Figure 4. Use Setup Manager to create or modify a distribution folder on the network.

DISK-IMAGE COPYING

Disk-image copying is the process of creating a master image, preparing that image for duplication using the Microsoft System Preparation tool, then copying that image to other systems using a third-party disk-image copying utility such as Norton Ghost available from Symantec or PowerQuest DriveImage. The master image can include applications and any custom settings in addition to the operating system. For more information about disk imaging, see the Deployment Resources on www.microsoft.com/windows.

Windows 2000 Professional supports hardware detection and Plug and Play, images can be copied onto computers with different modems, display adapters, and other hardware that is not critical during system startup. (For more information about copying images onto computers with hardware that is critical during system startup, see the “Remote Operating System Installation” section of this document.)

System Preparation Tool

The System Preparation tool prepares a system disk image to be copied to another system. To prepare a system to be copied, the System Preparation tool does the following:

- Adds a system service to create a unique local domain security ID (SID) upon first system start.
- Adds a mini-setup wizard that will run the first the system starts up. The mini-setup wizard prompts the user for user-specific information such as the End User License Agreement, product ID, user name, and company name. The mini-setup wizard can be scripted to eliminate user interaction.
- Forces the system to run full Plug and Play device detection. This allows the administrator to create an image on one computer, then copy it to another computer with a similar hardware configuration. The hard drive controller device driver and hardware abstraction layer (HAL) on both computers must be identical. Other peripherals such as network adapters, video adapters, and sound cards need not be identical.

Mini-Setup Wizard

The mini-setup wizard can be automated with the System Preparation tool answer file. It can also be run interactively, prompting the user with some or all of the following screens:

- Welcome
- End-User License agreement
- Product ID
- Regional settings
- User name and company
- Computer name
- Network configuration
- Join workgroup or domain (workstation only)
- Server licensing (server only)

-
- Time-zone selection
 - Finish/Restart.

Command line options

You can also apply the following command line options:

- **/quiet**—runs Sysprep without displaying onscreen messages. This is useful if you are automating Sysprep by adding it to the [GuiRunOnce] key of Unattend.txt.
- **/nosidgen**—runs Sysprep without generating a security identifier (SID). This is useful if you don't intend to clone the computer on which you are running Sysprep or if you are preinstalling domain controllers.
- **/pnp**—forces Plug and Play refresh on reboot. For example, if you have computers with similar hardware—the only differences being network cards, modems, or video adapters—you want Plug and Play to find and install these devices.

System Preparation Tool Answer File (Sysprep.inf)

The answer file used with the System Preparation tool is named Sysprep.inf. It uses the same syntax and key names as the Windows 2000 Professional Setup answer file, Unattend.txt. Unattend.doc on the Windows 2000 resource kit provides additional information about using an answer file. The following are the keys and the sections of the answer file that are supported:

[Unattended]

OemSkipEula– Skips the end-user license agreement (still displays the agreement).

OemPnPDriversPath– Valid when Plug and Play is specified and when additional drivers are needed.

InstallFilesPath– This is a pointer to the installation sources; it is useful if Regional Settings parameters are being specified.

[GuiUnattended]

AdminPassword

Autologon

TimeZone

OEMDuplicatorString– This answer-file parameter is new in Windows 2000 Professional. Its value is a string containing a description of the duplication tool used and any other information an OEM or administrator wants to store in the registry. The value can have a maximum of 255 characters. It is stored in

HKLM\System\Setup\OemDuplicatorString

OEMSkipWelcome.

[UserData]

Supports all keys.

[LicenseFilePrintData]

Supports all keys.

[GuiRunOnce]

Runs additional programs on first start.

[Display]

Supports all keys.

[RegionalSettings]

Supports all keys, provided that the files are available on the computer's hard disk.

[Networking]

Only supports the InstallDefaultComponents key.

[Identification]

Supports all keys.

[NetClients]

Supports all keys for Client Services for Microsoft Networks and Client Services for Netware.

[TapiLocation]

Supports all keys. The values are only valid if the computer has a modem. TAPI won't be prompted if it is omitted from sysprep.inf file. If the Setup Manager cannot find any sysprep.inf or values, the wizard prompts the administrator for this information.

Using the Same Image on Different Hardware Configurations

Using the System Preparation tool for Windows 2000 Professional, an administrator can use the same image on different hardware configurations that are compatible with the copied image. With this flexibility (which is bolstered by hardware detection and Plug and Play that are part of the operating system) the administrator can use disk duplication to conduct a fast, easy deployment on systems that aren't identical. After the operating system files have been copied to a local machine, Plug and Play detection runs through the process of detecting and installing (enumerating) hardware devices.

REMOTE OPERATING SYSTEM INSTALLATION

The Windows 2000 platform (client and server) includes another important change and configuration-management feature, Remote Operating System (OS) Installation. With Remote OS Installation, an administrator can use the Pre-Boot eXecution Environment (PXE) remote-start technology to install Windows 2000 Professional from a remote source onto a client machine's local hard disk. The remote source is any Windows 2000 Server that has the Remote Installation Services installed and configured to respond to requests by remote boot enabled client computers. The administrator can create Windows 2000 Professional setup shares that are CD-ROM based or disk-image based.

CD-ROM-Based Installation

The CD-ROM-based option is similar to setting up a workstation directly from the Windows 2000 Professional CD-ROM; however, the source files reside on the network on available RIS servers.

Once the images are posted to the RIS server, users equipped with remote boot-enabled client computers can request to install those images from any available RIS server on the network. Since the user can install the operating system alone from this point on, the administrator is free to complete other tasks.

Disk Image-Based Installation

Using the RIPrep imaging option, a network administrator can clone a standard desktop configuration, complete with OS configurations, desktop customizations, and locally installed applications. After installing and configuring Windows 2000, its services, and any standard applications on a computer, the network administrator runs the remote installation preparation wizard that prepares the installation image and replicates it to an available RIS Server on the network. Using the RIPrep imaging option, an administrator can also use the same image on systems with different storage controllers. Either the client computer's BIOS or a specifically configured remote-start floppy diskette can initiate a network service start. When an administrator requests a network service start, the Dynamic Host Configuration Protocol (DHCP) provides an IP address for the client computer. The client can then download the client installation wizard. The wizard prompts the user to log on, and, depending on the user's credentials or security group membership, the wizard then displays a menu that offers the appropriate installation options. The user's security level determines which unattended OS image they are able to install. The administrator may restrict the user to one OS choice, or they may allow the user to access a variety of unattended OS installation choices.

USING SYSTEMS MANAGEMENT SERVER

Administrators can use Microsoft Systems Management Server (SMS) to plan and execute a centralized deployment of Windows 2000 Professional upgrade packages to any number of desktop computers, regardless of the computer's location. Following are highlights of what SMS does to help the remote upgrade process:

- The flexible, dynamic target evaluation in SMS provides automated control over the systems that are being upgraded.
- Full status reporting, an integral part of Windows 2000 Professional setup, means that the administrator can manage and monitor distributed upgrades from a central location.
- Using SMS an administrator can conduct an upgrade in locked-down or low-rights environments.
- Since upgrades can be executed without a user logged on, SMS helps an administrator support headless servers (servers without user accounts) and conduct off-hours OS upgrades.
- Extensive scheduling options support varied deployment policies, including absolute mandatory, delayed mandatory, and optional.
- Automatic load balancing between distribution points accommodates large numbers of concurrent or near-concurrent upgrades.

Systems Management Server provides additional management features, such as support for pre-Windows 2000 and mixed environments, advanced software-distribution capabilities, remote software and hardware inventory management, license metering, and remote diagnostics functionality.

For more information on Systems Management Server visit www.microsoft.com/smsmgmt.

UPGRADING TO WINDOWS 2000 PROFESSIONAL

This section provides an overview of the key steps and considerations that an organization should take before upgrading desktop computers to Microsoft Windows 2000 Professional from earlier Windows operating systems. This paper does not attempt to outline the specific details of a complete Windows 2000 upgrade deployment; rather, it provides highlights of upgrading from each of the most popular operating systems used in business today.

Windows 2000 Professional enables companies to upgrade from any of the following operating systems:

- Windows NT Workstation 4.0
- Windows NT Workstation 3.51
- Windows 98
- Windows 95

The upgrade process for each operating system can be completely automated and scripted. In addition, administrators can use automated installation scripts to augment the upgrade, such as to add drivers that are not part of the standard Windows 2000 Professional installation.

Compatibility Checker

To help administrators plan upgrades, Microsoft provides a compatibility checker utility. This tool scans the system that generates a report—regarding any known software or hardware compatibility issues—before beginning setup or in stand-alone mode.

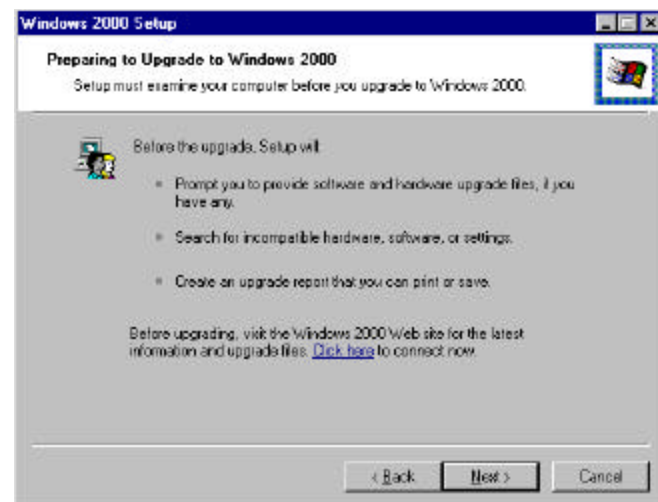


Figure 5. The Compatibility Checker scans the operating system that is being upgraded and then produces a report about any problems it has found that may arise during the upgrade process.



Figure 6. The Upgrade Report tells the administrator about any potential compatibility problems.

The administrator can create additional distribution folders from these reports. Folders may include missing components, such as upgrade device drivers, migration dynamic link libraries (DLLs), and other files. These additional files are then automatically installed as part of the installation scripts.

Upgrading from Windows NT Workstation 3.51 and Windows NT Workstation 4.0

Windows NT Workstation 4.0 provides the easiest upgrade to Windows 2000 Professional because they share a common heritage. The two operating systems also share the following core features:

- Same registry database and structure
- Same file system and folder architecture
- Same security architecture
- Same operating system kernel architecture
- Same device driver model.

For these reasons, an upgrade from Windows NT Workstation 4.0 requires significantly less planning and preparation than an upgrade from Windows 95 or Windows 98.

To upgrade from Windows NT Workstation 4.0 to Windows 2000 Professional, an administrator should follow these steps:

- Verify that the computers being upgraded have the appropriate drivers for the devices that need them.
- Replace or upgrade software, such as anti-virus software, that may rely on specific file systems.
- Run the setup program, which upgrades Windows NT Workstation 4.0 files. The administrator can fully script the setup program.

Upgrading from Windows 95 and Windows 98

Upgrading to Windows 2000 Professional from Windows 95 or Windows 98 requires more planning and preparation than upgrading from Windows NT Workstation 3.51 or from Windows NT Workstation 4.0 does. This is because the registry structure, file locations, and system function calls in Windows 95 and Windows 98 differ from those in Windows 2000 Professional. Straightforward or standardized corporate desktops should upgrade smoothly. Businesses or departments that primarily use Microsoft Office or other major commercial applications should also upgrade smoothly. However, businesses with customized line-of-business applications and third-party system utilities may require preparation before a smooth upgrade. The upgrade process itself involves preparing files that help ensure software compatibility, appropriate drivers, and additional Windows NT user information.

Ensuring Application Compatibility

Many applications install differently depending on which operating system is on the installation computer. Applications that were originally installed on a Windows 95- or Windows 98-based computer may not run properly on computers running Windows 2000 Professional without modification to ensure compatibility.

There are three ways to overcome this:

- Uninstall applications on the Windows 95 or Windows 98 computer and re-install after the operating system upgrade. This process is generally straightforward, assuming that the application setup can be scripted to run in quiet mode, but it does not work for every type of application.
- Create a new Windows NT Workstation-based standard configuration with compatible versions of the applications and copy this *image* onto multiple machines using disk-image copying tools. This approach is only suitable when the hardware configuration on the two computers is identical. Also, the administrator must conduct vigorous testing.
- Write or obtain a migration DLL file from the original software vendor for each application. A migration DLL is a program that converts the registry settings to make them compatible with Windows 2000 Professional. Because registry settings are unique, every application that installs differently based on the operating system must have a migration DLL as part of the upgrade. Microsoft will include migration DLLs from major independent software vendors as part of Windows 2000 Professional setup. Custom migration DLLs can be included as part of an automated installation script.

Key considerations in the Windows 95/Windows 98 upgrade process

Administrators should closely monitor DLLs, device drivers, and file system support during an upgrade or migration to Windows 2000.

DLLs: Businesses with internally developed line-of-business applications may want to consider writing migration DLLs for their in-house applications. Administrators can create migration DLLs to accomplish three things:

- Replace or upgrade Windows 95- or Windows 98-specific files with Windows NT Workstation compatible files.
- Move Windows 95 or Windows 98 application and user-specific settings that Setup did not detect to their proper location in the Windows 2000 Professional registry.
- Map Windows 95 or Windows 98 specific registry keys to the appropriate Windows 2000 Professional locations.

Device Drivers: Some devices and peripherals that work with Windows 95 or Windows 98 need updated drivers in order to work with Windows 2000 Professional. The driver update is necessary because some hardware drivers written for Windows 95 or Windows 98 and for 16-bit Windows 3x-based applications running on Windows 95 or Windows 98 were based on the older virtual (VxD) driver model, which Windows 2000 Professional does not support. Many of these drivers are available as part of Windows 2000 Professional setup. Drivers that are not part of setup can be added using scripts.

Recent drivers based on the Windows Driver Model (WDM) are compatible with Windows 2000 Professional; these drivers work without modification.

Many updated drivers will ship on the Windows 2000 Professional CD-ROM. However, when critical device drivers such as hard-drive controllers are not compatible with Windows 2000 Professional and cannot be found on the CD-ROM or elsewhere, the Setup program will abort the upgrade until updated drivers are available.

File System Support: Windows 2000 Professional will continue to provide support for existing file systems. FAT-16 and FAT-32 file system users have the option of converting to the Windows NT File System version 5 (NTFS5). However, compressed Windows 9x drives cannot be upgraded. These drives will need to be uncompressed before they can be upgraded.

INSTALLING SERVICE PACKS

Windows 2000 Professional makes it significantly easier for administrators to add service packs. Previously service packs had to be installed separately, after the operating system had been installed, Windows 2000 Professional supports service pack slipstreaming--the service pack is added directly to the operating system's distribution share during installation.

Windows 2000 Professional also eliminates the need to reinstall components that were applied before a service pack was installed. This makes it much easier to install service packs on existing systems. In the past, when service packs were applied, many previously installed components needed to be reinstalled. For example, when a service pack is applied to Windows NT Workstation 4.0, services such as IPX or RAS that had been installed previously have to be reinstalled. In Windows 2000 Professional, such services do not have to be reinstalled after service packs are applied.

FOR MORE
INFORMATION

For the latest information on Microsoft Windows® 2000 Professional, check out our World Wide Web site at <http://www.microsoft.com/windows/professional>.

For the latest information on the Windows 2000 Beta 3, check out the World Wide Web site at <http://ntbeta.microsoft.com>.